SCC Inc.

Specifications

Document No. TS-3210

October 23, 2023

Advanced Deaerator and Surge Tank Control

Product Description

The deaerator (DA), surge tank (ST), and condensate tank (CT) shall have a control system equal to a TS series control system. The system shall have the ability to control up to eight (8) pumps controlled with either motor starters or Variable Speed Drives (VSD). All eight pumps could be configured for 4 independent groups configuration for feed, or transfer water, with up to 4 independent manifolded headers. Flexible standard Modbus RTU, Modbus TCP/IP, BACnet MS/TP, BACnet/IP communication interface to the building management system (BMS) without a third party protocol converter, to provide streamlined data collection, and monitoring.

Sample Specification

1. The major components of the DA/ST control system shall consist of:
   - Mitsubishi FX5U programmable logic controller (PLC)
   - Weintek CMT3092X, 10 inch advanced touchscreen operator interface
   - Standard BMS communication protocols, Modbus RTU/RS485, Modbus TCP/IP, BACnet MS/TP, and BACnet/IP without a third party protocol translator.
   - Protocol translator shall translate Modbus TCP/IP to Ethernet/IP, Johnson Metasys N2, Profinet, or Profibus
   - 24 VDC power supply
   - Individual pump current switches
   - 7MF series pressure sensors, 7MF series differential pressure transducers, and Pt1000 ohm RTD temperature sensors
   - PLC based water level, and/or RWF55 single loop PID controllers for water level, Backup water level, and/or pressure control
   - PLC built in single loop PID controllers for water level, Backup water level, and/or pressure control
   - PLC single loop PID controllers for water levels, with RWF55s external backup water level load controller

2. The DA/ST control system shall have the following functionality:
   - The control system shall manage the lead/lag , or alternating pump start operations, sequencing, and rotation of up to 4 individual groups of feed and/or transfer water pumps, and/or condensate transfer pumps, via motor starters or Variable Frequency Drives
   - The control system shall maintain up to four individual feed or transfer water header pressures for 4 feed or transfer water groups of pumps, with four independents pressure setpoints
   - The system shall maintain the feed and transfer water pressures for four groups of pumps up to two tanks regardless of if they are single or split tanks.
   - The system shall display graphically tanks and pumps configuration

- The system shall maintain an adjustable water level setpoint in the DA, ST, and/or Condensate tanks
- The system shall maintain an adjustable DA tank pressure setpoint
- The system shall maintain a backup emergency water level, and pressure adjustable water level via stand alone load controller such as an RWF55 controller
- The system shall start and stop the feedwater or transfer water pumps based on the following:
  - An adjustable ON/OFF pressure setpoint, sensed via a transducer in the common feedwater header
  - Feedwater or transfer water pressure setpoints, sensed via transducers in the common discharge headers
  - Feedwater control setpoint based on the main steam header pressure, and a setpoint offset above steam header pressure.
  - Boiler start/stop command to feedwater pumps, one pump start per boiler, or two pumps one pump start per boiler at a time, with second pump alternation, pumps mut be manifolded.
- The system shall provide appropriate information on functionality and status of all pumps by monitoring the following:
  - Current transformer switches
  - Tank pressure
  - Temperature
  - Feedwater or transfer water pump common header pressure

3. The DA/ST control system shall have the following features:
   - Ability to configure the touchscreen overview screen graphics to match the actual tanks and pumps configurations
   - Ability to maintain feedwater and transfer water up to 4 manifold pressure setpoints, based on an adjustable 4 independent setpoints
   - Ability to lead and lag with 4 sperate PID loop control for 4 separate headers for up to four groups of feedwater or transfer pumps
   - Ability to start the feedwater pumps, based on dry contact call from each boiler, one boiler, one pump, with no backup pump when the pumps are not manifolded
   - Ability to start the pumps, based on dry contact call from each boiler, one boiler, one pump, with backup pump when the pumps are manifolded
   - Ability to maintain DA and ST water level, based on an adjustable setpoint
   - Ability to transfer water from condensate tank to DA/ST, based on condensate tank water level
   - Ability to monitor high, low, and low/low water switch status
   - Ability to monitor pump status via current switches or differential pressure switches
   - Ability to monitor the system and actuate alarms
   - Feedwater and transfer pumps lead/lag rotation based on run time hours
   - Ability to monitor and/or control DA steam pressure
   - Ability to monitor DA and ST water levels, and perform full PID water level control
   - Ability to provide high and low water alarms via the load controller, when the low and high floats are not present
   - Ability to control pumps via motor starters or VSDs

- Ability to control a standby backup pump, regardless of the tanks configuration, up to four backup pumps, one per group of pumps.
- Ability to control the backup pump to replace any failed pump in any group or when a boiler starts control is selected.
- Ability to run the pumps in manual mode via the HAND/OFF/AUTO selector switch in hand, even if the PLC and the touchscreen are corrupted, or damaged
- Ability to maintain accurate water levels with the RWF55 load controller, even if the PLC and the touchscreen are corrupted, or damaged
- 10 inch touchscreen advanced human machine interface (HMI)
- The standard building automation system interface shall be Modbus TCP/IP, BACnet IP, BACnet MS/TP, and Modbus RTU/RS485, without additional protocol converters
- Ethernet/IP (Allan Bradley), Profibus, Profinet, LonWorks, or Johnson Metasys N2, shall be optional protocols
- Field configurable RTD and analog inputs, 4 Pt1000 RTD's and up to 8 analog inputs
- Ability to externally add redundant DA or ST water level control
- Display graphics representing job specific pump configurations, and pipping
- Display graphics representing tray or spray type DA, or no spray no try.
- Ability to display low and high water level alarms off of the water level controller when low/high floats are not available
- Ability to remote monitor via smartphone, tablet, or PC via third party VNC based software

4. The DA/ST control system shall have the following lead/lag features with motor starters:
   - Each pump motor shall have a status monitoring current switch
   - Pump status and run mode shall be displayed on the HMI, indicating pump availability and position (lead/lag)
   - High pressure, minimum pressure, and time delay shall be entered on the HMI when the desired feedwater header pressure is met and/or the transfer water pump is operating
   - Each pump shall have a HAND/OFF/AUTO selector switch
   - The pump selector switch shall be placed in AUTO position to follow the lead/lag sequence, and to allow the DA/ST control system to monitor the feedwater or transfer header pressure
   - The pump selector switch shall be placed in HAND position to allow continuous run, unless there is an alarm present or low water level is detected
5. Motor starter sequence of operations shall consist of the following: (This sequence also applies to differential pressure setpoint between the main steam header and feedwater manifold pressure)
   - The lead pump shall be activated and run continuously
   - Lag 1 pump shall start if the feedwater header pressure or transfer pump header pressure drops below the minimum pressure setpoint for an adjustable time delay between 0 and 30 minutes
   - With Lead and Lag 1 running, Lag 2 pump shall start if the feedwater header pressure drops below the minimum water pressure setpoint for a time exceeding the adjustable start delay
   - The system shall keep adding lag pumps whenever the feedwater or transfer header pressure drops below the minimum allowable pressure setpoint
   - The last lag pump shall be dropped offline when the combination of lead and lag pumps raise the feedwater or transfer header pressure above an adjustable pressure setpoint for an adjustable period of time

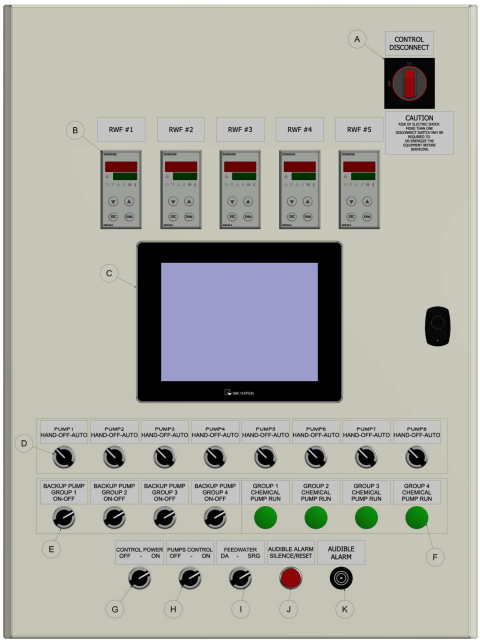
- The second to last lag pump shall be dropped offline if the pressure rises above the high pressure setpoint for a time exceeding the adjustable stop delay
- The system shall continue to shut down lag pumps whenever the feedwater or transfer header pressure rises above high pressure setpoint for a time exceeding the adjustable stop delay
- The PLC and/or RWF55 water level control shall modulate the DA or ST makeup water valve to maintain the desired water level
- The PLC and/or RWF55 water level control shall modulate the steam balancing valve to maintain DA steam pressure setpoint, if applicable
- The PLC and/or RWF55 water level control shall provide a low and high water alarms setpoints when the low and high water floats are not present, if applicable
- The lead pump shall be rotated back to the last pump in the lag sequence, based on lead pump operating time
- The lead pump rotation sequence shall be: 1,2,3,4,5,6 – 2,3,4,5,6,1 – 3,4,5,6,1,2 etc.
- If the online lead or lag pump fails, the next pump in the sequence shall be activated

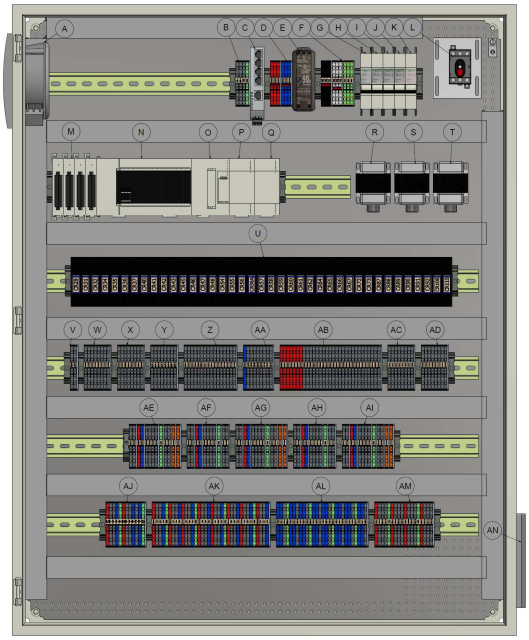
6. Lead/lag sequence of operation with a VSD shall consist of the following:
   - If the feedwater or transfer header pressure is below setpoint, the system shall activate the lead pump VSD, and execute a PID algorithm based upon the programmed header pressure setpoint
   - The lead pump VSD shall activate after it receives the start signal via a dry contact from the PID control output
   - The lead pump VSD shall provide a VSD start proven via a dry contact to insure proper start operation
   - The lead pump VSD shall modulate to maintain feedwater or transfer header pressure setpoint
   - If the PID output approaches the lag pump start setpoint for an adjustable start delay, Lag 1 pump VSD shall be started, start proven, and receive the same modulating signal as the lead pump
   - The lead and lag pumps shall run and modulate in unison to maintain the setpoint
   - Lag 2 pump VSD shall start, start proven, and receive the same modulating signal if the system PID output approaches lag pump start setpoint for a time exceeding the adjustable start delay
   - The system shall keep adding and modulating pumps when the PID output reaches the lag pump start setpoints
   - The last lag pump shall be dropped offline if the PID output drops to the drop pump output setpoint for a time exceeding the adjustable stop delay
   - The second to last lag pump shall be dropped offline if the PID output drops again to the pump drop output setpoint for a time exceeding the adjustable stop delay
   - The system shall continue to shut down the lag pumps when the PID output drops below the pump drop setpoint for a time exceeding the adjustable stop delay
   - The lead pump shall be rotated back to the last pump in the lag sequence, based on lead pump operating time
   - The lead pump rotation sequence shall be: 1,2,3,4,5,6 – 2,3,4,5,6,1 – 3,4,5,6,1,2 etc. If the online lead or lag pump fails, the next pump in the sequence shall be activated

Dimensions

For dimensions, reference TS-3200 Technical Instructions Document.

Parts Description





A.	Cooling Fan	**U.**	Relays
B.	Modbus RS485 Terminals	**V.**	Remote Alarm Terminals
C.	Protocol Converter	**W.**	Low Feedwater Pressure Alarm Terminals
D.	24VDC Terminals	**X.**	Chemical Pump Start Command Terminals
E.	24 VDC Power Supply	**Y.**	Backup Pump Start Command Terminals
F.	120 VAC and Ground Terminals	**Z.**	Pump Start/Stop Command Terminals
G.	Cooling Fan Circuit Breaker	**AA.**	Pump Run Light Terminals
H.	Water Level Circuit Breaker	**AB.**	Digital Input Terminals
I.	Water Level Circuit Breaker	**AC.**	BMS Pump On/Off or Boiler Start Control Terminals
J.	Water Level Circuit Breaker	**AD.**	PLC K1/K6 Water Level Terminals
K.	System Power Circuit Breaker	**AE.**	1st RWF55 Controller Terminals
L.	System 120 VAC Disconnect	**AF.**	2nd RWF55 Controller Terminals
M.	Analog and RTD Input Modules	**AG.**	3rd RWF55 Controller Terminals
N.	Programmable Logic Controller (PLC)	**AH.**	4th RWF55 Controller Terminals
O.	Temperature Controller Module	**AI.**	5th RWF55 Controller Terminals
P.	Input Output Module	**AJ.**	Built-in Analog Input and Output Terminals
Q.	Second Input Output Module	**AK.**	Analog Input Terminals
R.	Feedwater 24 VAC Transformer	**AL.**	Analog Output Terminals
S.	2nd Feedwater 24 VAC Transformer	**AM.**	RTD Terminals
T.	3rd Feedwater 24 VAC Transformer	**AN.**	Fan Exhaust

A.	Main 120 VAC Lockable Disconnect Handle	**G.**	Control Power Switch
B.	RWF55s for Water Level and Pressure Control	**H.**	Pump Control On/Off Switch
C.	Touchscreen	**I.**	Feedwater Selector Switch
D.	Hand/Off/Auto Pump Switches	**J.**	Audible Alarm Silence/Reset Button
E.	Group Backup Pump On/Off Switch	**K.**	Audible Alarm
F.	Group Chemical Pump Run Light		